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# FINNISH MONETARY POLICY IN THE CREDIT RATIONING ERA*

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*This paper suggests an analysis of monetary policy reactions in a typical Finnish business cycle during the regime of credit rationing. We start by presenting a macroeconomic model which incorporates the institutional characteristics of repressed financial markets and which can generate cyclical behaviour of the main variables that corresponds to stylised facts. The model is then used to motivate the estimation of an empirical reaction function of monetary policy. We conclude by discussing the strategic policy choices in the light of the empirical results. (JEL E52, E58)*

## 1. Introduction

The purpose of this paper is to analyse monetary policy in Finland during the years of credit rationing. The effectiveness of monetary regulation and the actual policy performance have been intensively debated amongst Finnish policymakers and economists.[1] To increase our understanding of these policy experiences, we investigate the systematic elements of the policymakers' reaction patterns in a typical business cycle.

Section 2 starts with a brief survey of the post-war system of credit rationing and the related economic discussion. In section 3, we sketch a simple macroeconomic model of the Finnish economy. In order to capture the system of repressed financial markets prevailing in Finland up to the early 1980s, we keep the asset structure of the model extremely simple. The model can be characterised as a Mundell-Fleming economy with excess demand for credit. The role of the interest rate in the standard IS–LM model is here played by the banks' discount debt position. The model incorporates ideas that have been used in Finnish macroeconomic research[2] and policy analyses, and

* *Discussions with Juha Tarkka and comments from two anonymous referees have improved this paper, while the responsibility for remaining weaknesses is of course entirely ours.*

[1] *See section 2 below and Tarkka (1988) for a survey.*

[2] *The main references are Willman (1981), Kähkönen (1982) and Oksanen (1980).*

reporting one such model may be of interest for an English-speaking readership.

In section 4 we use the model to interpret the stylised facts of a typical Finnish business cycle by comparing its qualitative predictions with the dynamic behaviour of the corresponding empirical variables. This analysis supports our belief that the model provides a reasonable theoretical reference for the analysis and interpretation of monetary policy reactions. In section 5 we use the empirical counterpart of the model's main policy variable to characterise the systematic elements of monetary policy.

There is a well-known tradeoff in the selection of good policy indicators. One would like to measure the policymaker's reaction by using a variable that is exogenous to the economy in the sense that the authorities can control it as fully as possible. On the other hand, one would like to use a variable which is macroeconomically as relevant as possible. A good indicator variable should be both controllable and macroeconomically relevant, but it is hard to meet both requirements.[3] We believe that our macroeconomic model does a good job in bridging part of this gap and in generating an interesting policy variable, the optimal amount of the banks' central bank debt. In any case our analysis brings new information, since most analyses of policy reactions have focused on the marginal interest rate of the central bank debt.

Monetary policy is here modelled in terms of a single instrument, the banks' optimal amount of central bank debt. The optimal debt may be computed by using information about the relevant (administratively fixed) interest rates, as in Oksanen (1977). Oksanen computes this series for years 1950–1963 and 1968–1973. The series is completed for years 1964–1967 and 1974–1980 in Vartiainen (1986), where a detailed description of the computation procedure is found.

Once the picture of typical reactions has been drawn, it is interesting to look more closely at the crucial policy choices as they appear in official documents. In section 6 we discuss the decisions related to monetary steering, especially those that were made in the 1950s. Some of the empirical characteristics of monetary policy reactions can be traced to political choices and explicit statements. In this way, the importance of political processes and policymaking institutions is appreciated.

## 2. A survey of the credit rationing system and the related discussion

Roughly speaking, the credit rationing system was operative from the early 1940s to the early 1980s. Some of its elements were introduced already in the 1930s and its gradual erosion started at the end of the 1970s. The financial market conditions in Finland during the era of credit rationing can be characterised by the following stylised facts:

1) all relevant interest rates were administratively fixed;
2) credit was in excess demand for most of the time;
3) the deposit banks mediated an overwhelming share of the available saving to finance investment; other markets for short term assets were thin and the tax system favoured loan financing at the expense of equity capital;
4) foreign capital flows were strictly controlled and played a minor role until the mid-1970s;
5) the terms of the central bank debt of the banks was the main channel of monetary policy.

This environment evolved as a response to political demands as well as new interventionist economic thinking.[4] From the thirties onwards, there were political pressures for lower interest rates. After WWII, overall skepticism about the ability of free markets to generate economic growth increased in politics as well as in economics. The state had been actively involved in economic planning during the war. Although the Finnish economists' community was slow in internalising Keynesianism, the typically Keynesian objective of permanently low interest rates was adopted. Interest rates became rigid and monetary policy had to operate by changing the terms of the banks' discount debt. The banks allocated their loans to productive investment projects that met the criteria set by the Bank of Finland.

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[3] *Cf. the discussion by Blinder and Solow (1974) on fiscal policy indicators.*

[4] *These events and the institutional history of Finnish credit markets have been surveyed (in Finnish) by Tarkka (1988) and Pekkarinen – Vartiainen (1993).*

The Bank of Finland influenced the banks' supply of loans by changing the terms of their central bank debt. The effectiveness of this policy instrument was often questioned, and it is an interesting observation that the Bank of Finland did at several occasions look for other means of controlling the loan markets. On the other hand, a reading of the relevant policy documents, such as the memoranda of the parliamentary deputies of the Bank of Finland, shows that the terms of the central bank debt clearly were, whether efficient or not, the main policy instrument around which debates were centered. Changes in loan and deposit interest rates were regarded as politically sensitive and were not used very actively.

Within economic research, these institutions generated models that aimed at capturing the characteristics of the rationed credit markets. Of this literature, one should mention the contributions by Willman (1981), Kähkönen (1982) and Oksanen (1980), from which the simplified model of this paper borrows heavily. The earlier versions of the Bank of Finland quarterly model also had a similar structure. The main idea of this generation of economic models was to include a measure of tightness of credit rationing or loan expansion in the economy's expenditure function and to model the determination of loan expansion as a result of the banks' optimisation. In this way, the models can be seen as credit rationing analogies of the Keynesian IS–LM-model prevalent in the macroeconomics of the time. The macroeconomic theory of rationed credit markets was investigated by Willman (1981) and Kähkönen (1982). Empirical research focused on the behaviour of the banks and the effectiveness of discount window measures as an instrument of monetary policy. Tarkka (1980) suggested that periods of excess supply of credit could also be identified from the data. Oksanen (1977) showed that the terms of the banks' discount debt did indeed have an influence on the banks' supply of loans. Similar conclusions were arrived at by Tarkka (1985).

## 3. *A macroeconomic model with repressed financial markets*

This section presents a simple macroeconomic model which captures the five stylised facts of the previous section. The model's basic structure is analogous to that of the IS–LM model and the Mundell-Fleming model, so that output is determined by demand which depends on income and the tightness of monetary policy. A balance of payments imbalance feeds into credit markets. The role of the interest rate is here played by the availability of central bank debt at the discount window, so that the marginal cost of discount money becomes the shadow interest rate of the economy. This is a standard model, the basic idea of which is similar to the models mentioned in the previous section.

There are three sectors in the economy: the private sector, the banking sector and the central bank. In accordance with the stylised facts, the asset structure is very simple. The public can hold only cash (NP) and deposits (D) (there are no domestic or foreign securities). The banks issue loans (L) financed by deposits and central bank debt (H). They are also required to hold reserves at the central bank (NB). The central bank's assets consist of foreign currency (F) plus the debt of the banks. The balance sheets of the public, the consolidated banking sector and the central bank are thus given by

(1) $NP + D = W + L$ (public)

(2) $L + NB = H + D$ (banks)

(3) $F + H = NP + NB$ (central bank),

where W denotes the public's net financial wealth. Cash earns no interest. The interest rates on deposits ($r_d$), loans ($r_l$) and required reserves ($r_b$) are administratively fixed. The central bank steers the speed of credit expansion by changing the terms of the banks' central bank debt.

The loan interest rate $r_l$ is low relative to the returns of real capital investment and the time preference of consumers. This means that banks can sell all the loans they want and private agents are rationed. Hence, the behaviour of the banks at the discount window is a crucial mechanism of the model.

The exact terms for discount window borrowing in Finland have varied, but for most of the time the banks have been able to borrow a given quota at a low discount rate, and as the amount of debt has increased, the interest rate on the entire debt has increased more or less linearly. Since the discount rate has always been below the lending rate, the static optimum of the central bank debt – which maximises the profit stream of the banks – has always been on the upward sloping part of the schedule, and we can approximate the discount rate R by

$$(4) \quad R(H) = h_0 + h_1 H,$$

where $h_0$ and $h_1$ are positive constants. The central bank operates by changing the size of the quotas and the steepness parameters, i.e. by changing $h_0$ and $h_1$.

It is possible to compute an optimal central bank debt level for the banks, H*. This H* and the behaviour of the discount debt H outside this optimum can be derived from the banks' optimisation problem in the following way. A bank's instantaneous cash flow is

$$(5) \quad f(L, \dot{L}, H) = r_l L - r_d D + r_b NB - HR(H) - C(\dot{L}).$$

The last term reflects the assumption that adjustment of the loan stock involves costs, since new resources must be invested to monitor applicants and evaluate collaterals. We assume that the adjustment cost is quadratic, so that

$$(6) \quad C(\dot{L}) = c\dot{L}^2,$$

where c is a positive constant. The bank's instruments are its stock of loans L and central bank debt H, and it is subject to the constraints given by the balance sheet (2) and the reserve requirement

$$(7) \quad NB = bD.$$

We argue that it is reasonable to see the bank's problem as one with one decision variable only. In strongly oligopolistic markets, there has been a clear connection between a bank's loans and its deposits: a part of the loans issued by a big bank has returned in the form of deposits to the same bank, to the extent that this feedback effect has played a nontrivial role in the banks' decision process (see Oksanen, 1977). Hence, we may write

$$(8) \quad D = D_0 + wL,$$

or $\dot{D} = w\dot{L}$. With these assumptions, the bank's dynamic optimisation problem is

$$(9) \quad \max_{\{L(t)\}} \int_0^T e^{-\beta t} [A_0 L - A_1 L^2 - c(\dot{L})^2] \, dt,$$

where $A_1 = h_1 \; [1-w(1-b)]^2$ and $A_0 = r_l + w \; (r_b b - r_d) - h_0 \; [1-w(1-b)]$ are positive constants that depend on the interest rate parameters and the feedback coefficient w. We show in the Appendix that the solution for loans is

$$(10) \quad \dot{L} = a(L - L^*), \; a < 0,$$

so that the adjustment speed of the loan stock depends on the size of the gap from the long-run optimum $L^* = 2A_0/A_1$. The long-run optimum L* can be computed from the interest rate data. To this optimum loan stock corresponds an optimal amount of central bank debt H*, which only depends on the structural parameters. Then, given H* or L*, the other one can be obtained from the banks' budget constraint.

The central bank can affect the banks' behaviour by changing the structural interest rate parameters $r_l$, $r_d$, $r_b$, $h_0$ and $h_1$. The last two parameters have played the most active role in stabilisation policy. One needs a useful way of summarising this information. One way of doing this is to use the optimal level of central bank debt as the policy instrument: if the central bank understands the banks' optimisation process, it can set H* wherever it wants by changing its discount window policy (i.e. $h_0$ and $h_1$). Thus, H* summarises the information about the interest rates and the availability of central bank debt. It is in principle completely controlled by the central bank.

The public's demand for cash, NP, is always satisfied and obeys a transaction motive so that NP is a fraction[5] of income Y:

$$(11) \quad NP = nY.$$

In Keynesian vein, it is assumed that there are unutilised resources in the economy and that the level of activity is constrained by credit rationing. Thus, we write expenditure E as a function of income Y and loan expansion $\dot{L}$. We do not present sophisticated microfoundations for this function, but it seems clear to us that this specification does not contradict

[5] *See Willman (1991, p. 24), who argues that the relation between the amount of currency and national income has been very stable in Finland.*

assumptions of rationality. It suffices to assume that the loan rate $r_l$ is lower than the return on real investment (a plausible assumption in an economy with credit rationing and undergoing late industrialisation). Alternatively, one can think that the time preference of the consumer is such that the consumer would like to spend more than what is allowed for by the borrowing constraint. Thus, the private agent would like to increase L and use the increase to buy more consumption goods or productive capital, thereby increasing output and income. This he cannot do since the amount of loans is determined by the banks' supply. The deposit rate $r_d$ is also low, but the agent must keep a part of his wealth in deposits in order to alleviate uncertainty and to keep up his customership in a bank and hence access to loans.[6]

The expenditure function E summarises the public's behaviour under these restrictions, and the following dynamic budget constraint yields the demand for goods $Y^d$:

$$(12)\quad Y^d = E(Y, \dot{L}) + X - mY, E_Y, E_{\dot{L}} > 0,$$

where X is exports and mY is a linear import function. An increase in the loan stock will increase demand, since there is excess demand for credit. The function E contains the information about the consumers' and firms' optimal choice of consumption and income paths. We could easily equip the model with a public sector, i.e. government expenditure and taxation, but it would play no role in this analysis that focuses on monetary policy.

The adjustment of output is assumed to be given by the following dynamic equation:

$$(13)\quad \dot{Y} = y(Y^d - Y), y > 0,$$

which says that output adjusts to excess demand. When $Y^d = Y$ does not hold, the goods market is out of equilibrium. There are two possible justifications for this equation (cf. Blanchard – Fischer, 1989, ch. 10): either demand E adjusts slowly to its determinants or firms first increase or run down their inventories instead of changing output when confronted with changing demand.

We now have a closed macroeconomic model. Goods market disequilibrium means that demand and supply of goods are not equal and therefore Y changes. We define credit market equilibrium as a state where $\dot{H} = 0$ so that the central bank debt of the banks remains constant. Note that since expenditure depends on the change of loans, there is generally no steady state with both Y and L stationary.

Recalling (10), it is possible to eliminate all endogenous variables other than H and Y, so that we get a dynamical system in two variables, the central bank debt of the banks and national income:

$$(14)\quad \dot{H} = (1-b)\{ny[E(Y, a(H-H^*)) + X - (1+m)Y] + a(H-H^*) - X + mY\}$$

$$(15)\quad \dot{Y} = y\{E[Y, a(H-H^*)] + X - (1+m)Y\}.$$

The stationary for equation (15) is analogous to the IS-curve and is pictured in Figure 1 as the EE-curve, with slope $(1 + m - E_y)/aE_{\dot{L}} < 0$. The condition $\dot{H} = 0$ from (14) entails a curve with slope $m[y(1+m-E_y)-1]/a[\frac{b}{1-b} + ymE_{\dot{L}}]$. The denominator of this expression is negative, but the sign of the nominator depends on the relative magnitude of the speed of output adjustment y. If y is small enough, the slope of the stationary is positive and we have an HH-curve corresponding to condition $\dot{H} = 0$ as pictured in Figure 1, with the arrows indicating the dynamics outside steady state. With the above assumptions about the signs of the parameters of the model, it is easy to show that the Jacobian of the system around the steady state has characteristic roots with negative real parts, so that the system is locally stable.[7]

The inspection of (14)–(15) reveals the logic of the model. Output is at rest when demand equals supply. The discount debt is at rest when the demand disequilibrium, the banks' portfolio disequilibrium and the balance of payments match each other appropriately weighted. The steady state of the model can accommodate a disequilibrium in the balance

[6] *See e.g. Kähkönen (1982) for a similar model with sophisticated microfoundations.*

[7] *If the slope of the HH-curve were negative but less steep than that of the EE-curve, the system would also be stable and we would have a monotonous adjustment of output and discount debt to steady state levels.*

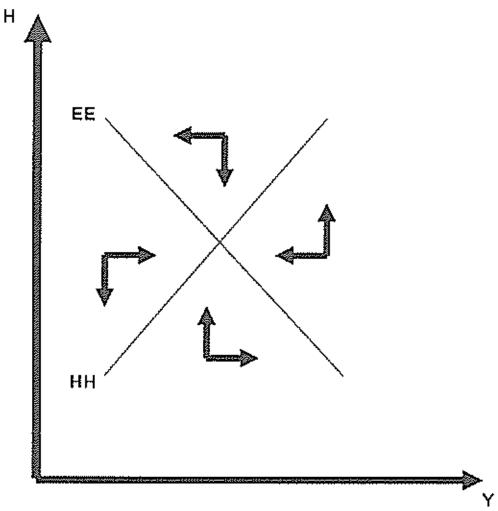


Fig. 1.

of payments if b is positive, so that the continuous monetary flow due to external disequilibrium is matched by a movement in deposits and bank reserves. If b = 0, equilibrium entails X = mY. A steady state in terms of H and Y need not imply that all variables are steady: there may be a continuous movement in L, D and F. Thus, in a steady state as defined above, we might have income constant, H unequal to H*, but the gap persisting, since deposits D, loans L and the target level for loans L* all move. This is logical in a short-run fix-price model.

Taking Figure 1 as the benchmark case, let us investigate the comparative statics of the model. An increase in exports moves the EE-curve up (a familiar multiplier effect) and the HH-curve down (with more exports, a given level of income can be achieved with less central bank debt), so that income increases unambiguously whereas central bank debt may increase or decrease. An increase in demand[8] moves both curves up, so that discount debt unambiguously increases, whereas national income may increase or decrease. This effect is analogous to the familiar crowding out effect of fiscal policy in the IS–LM model: increasing G increases demand but tightens the credit market.

Finally, consider H*, the very object of interest of this paper. An increase in H* also moves both curves upwards, and one can show that dY/dH* = 0 locally, so that once-for all changes in H* do not affect the long run equilibrium. This is obvious if one bears in mind that we have specified the expenditure function in terms of loan expansion so that a lasting change in income can be brought about only by a higher growth in loans. If the authorities choose a higher rate of growth in H*, they also choose a higher equilibrium income. The model is a short run one and it captures the »very short run» impact of monetary policy. This specification is attractive because it makes the model comparable to those of the IS–LM tradition. Expenditure is E[Y,a(H–H*)], and the gap (H–H*) is a measure of the (shadow) interest rate at which the private sector obtains new discount money. When H is high relative to H*, the shadow interest rate (marginal cost of the central bank debt) is high, and expenditure therefore low – and vice versa. When H* is increased, this momentarily lowers the shadow interest rate and increased expenditure and income, but as the new money is absorbed, the economy returns to original equilibrium, as the marginal cost at the discount window rises to its equilibrium level. That an increase in H* is expansionary in the short run can be seen from the dynamic arrows of Figure 1: if both curves shift upward so that their intersection does not move horizontally, the economy will first move upwards and to the right.

Note that these balance-of-payments dynamics are exactly analogous to the conventional fixed exchange-rate Mundell-Fleming model (or IS–LM model) with a feedback mechanism from the balance of payments to the money supply: in that model an increase in the money stock is expansionary in the short run but the economy returns to the long run equilibrium as the balance of payments deficit contracts the money supply. In that sense, monetary policy has no long run effect in the IS–LM model either.

Cash reserve policy (changes in b and $r_b$) was never used very actively in Finland. In the

[8] *We haven't included parameters other than the arguments Y and L̇ in the expenditure function, so that a change in the expenditure function cannot be formally analysed with the model. A change in expenditure is here interpreted as a shift of the expenditure function. Such a shift may be the result of, say, changed expectations and time preferences.*

Table 1.

| | Correlation with GDP | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | t–4 | t–3 | t–2 | t–1 | 0 | t+1 | t+2 | t+3 | t+4 |
| GDP (Y) | .35 | .40 | .55 | .54 | 1.0 | .54 | .55 | .40 | .35 |
| Discount window debt (H) | –.24 | –.13 | –.06 | .05 | .15 | .29 | .40 | .47 | .53 |
| Exports (X) | .13 | .13 | .20 | .20 | .35 | .13 | .15 | .07 | –.05 |

theoretical model, one can show that if the reserve requirement b is nonzero and stays constant, changes in $r_b$, the interest rate paid for the banks' reserve deposits, affect loan expansion in an expected way: an increase in $r_b$ boosts loan expansion whereas a decrease is contractionary. The intuitive reason is that a high $r_b$ makes it attractive to increase lending because lending generates new deposits that can in turn be deposited in the central bank. Changes in b have ambiguous effects. An increase in the reserve requirement ratio decreases the target level of loans but increases the speed of adjustment $|a|$. Thus, an increase in b could be inappropriate when the economy is in a boom and the banks are below their optimal lending level. A decrease in b would be appropriate if the economy is entering a recession and the banks are decreasing their loan expansion. Then a decrease in b would increase the banks' target level for loans and decrease their speed of downward adjustment.

## 4. *Describing the business cycle*

In this section we show that the theoretical model can generate behaviour in Y and H which is broadly in line with empirical observations. The model allows a plausible interpretation of the Finnish business cycle. According to conventional wisdom, the Finnish business cycle has been led by changes in export demand, so that an upswing is generated by an increase in exports. Towards the end of the boom, domestic demand catches up while export growth slows down, and at this stage money markets tighten as the banks increase their central bank debt. Recession starts when domestic demand is still fairly high while export demand decreases. As the recession matures, the banks' central bank debt decreases as domestic demand decreases. This rhythm can be represented in the following qualitative table of business cycle phases:

| phase | characterisation | X | Y | H |
|---|---|---|---|---|
| I | early boom | up | up | low |
| II | late boom | down | up | high |
| III | early recession | down | down | high |
| IV | late recession | up | down | low |

This structure, where fluctuations in exports »lead» fluctuations in gdp and movements in the banks' discount window debt follow with a lag, may be compared with the correlation coefficients in Table 1. These »business cycle phenomena» have been calculated on detrended and deseasonalised data.[9] All series have been expressed in real terms (deflated by the gdp deflator) and in logarithms. This way of summarising the stylised facts of business cycles have now become a standard practice in the macroeconomic literature (see e.g. Prescott 1986).

The cross-correlations of exports and the banks' central bank debt with national income suggest that exports are pro-cyclical, but »coincident» rather than »leading»; $Y_t$ is more strongly correlated with $X_t$ than with previous values of X. The conventional wisdom is more in line with the evidence on the cyclical behaviour of the banks' discount window borrowing, since future realisations of H are strongly correlated with present gdp. H thus appears to be » lagging».

[9] *Specifically, the GDP series consists of the residuals from a regression of GDP on a linear trend, a quadratic trend and three sets of seasonal dummies, using data from 1953:1 to 1983:4 (there are significant shifts in the seasonal pattern in 1953 and 1971). Similarly, the series on exports consists of the residuals from a regression on linear trends and seasonal dummies, where we have allowed for a break in the trend as well as the seasonal pattern in 1966. Finally, the empirical counterpart of the cyclical component of H is a series of residuals from a regression of the banks' central bank debt on a linear and a quadratic trend (there is no significant seasonal pattern in H).*

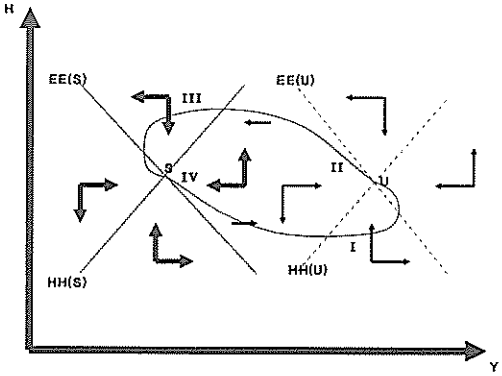


Fig. 2.

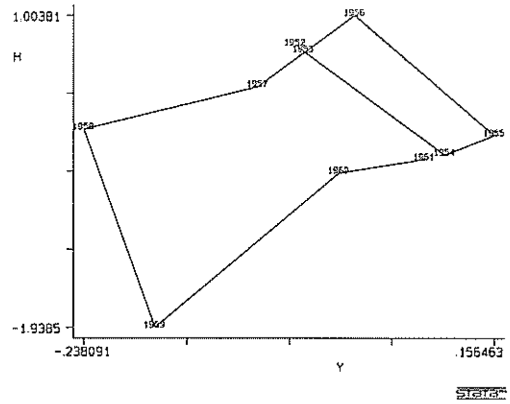


Fig. 3a.

An analytic representation of a typical business cycle in our theoretical model is depicted in Figure 2, where we compare the steady states of the system with different positions of the exogenous export variable X. Assume that there are two positions for exports: either X = X(U) (»upswing») or X = X(S) (»slump»), with X(U) > X(S). An increase in X moves both curves rightward, so that the two corresponding steady states U and S can be depicted as in Figure 2. The solid curves and bold dynamic adjustment arrows correspond to the »slump» where X = X(S) and the broken lines and thin arrows to »upswing» with X = X(U).

Imagine now that X shifts back and forth between these two positions. If S is the initial equilibrium, let X shift to X(U) so that the new steady state is at U. The economy now starts to move according to the dynamics indicated by the thin arrows, on the path towards U, eventually reaching it. Now let X shift back to X(S); then the dynamic adjustment will be according to the bold arrows, on the path towards initial equilibrium S. In this fashion, if X moves up and down, the model predicts a counterclockwise circular motion of the economy in Y–H-space, with the phases of the above table as written on the »orbit» drawn in thin continuous line.

The story fits well the stylised facts that come out if one examines the behaviour of the corresponding empirical time series. Figures 3a through 3c depict the corresponding empirical variables, again measured as deviations from a trend with seasonal components.[10] The

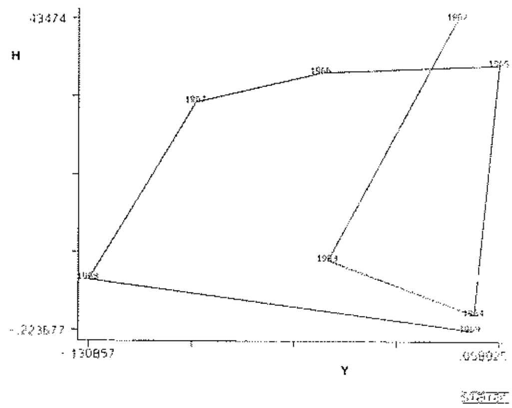


Fig. 3b.

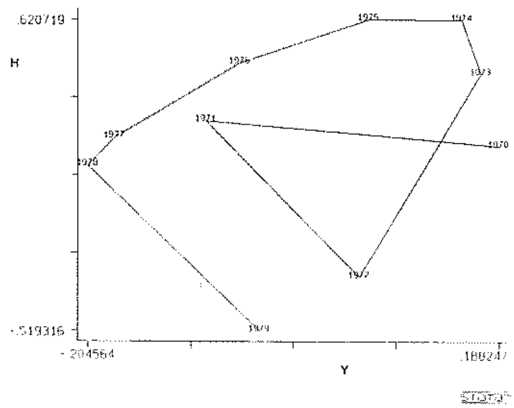


Fig. 3c.

[10] *We are grateful to Per Wiker, FIEF, for assistance in the production of these figures.*

yearly observations used in Figures 3a–3c have been derived from the quarterly series used in Table 1. For H, which is a stock variable, we have selected the observation of the second quarter each year, whereas the flow variable Y has been defined as the sum of the quarterly cyclical components of gdp for each year. The yearly series are divided into three subperiods, each of them covering one decade and two full cycles (see e.g. Hjerppe (1989) or Öller (1983) for this periodisation). The figures depict cyclical motions true to the above story. For example, the years 1953–55 were years of high growth, and we see that national income grows while H declines. When recession approaches, H initially increases. A more or less similar story can be told for every cycle depicted in the figures.

## 5. *Estimating the policy reaction*

The monetary policy variable H* was exogenous in the theoretical model. However, it is sensible to think that the policymakers adjust H* in a systematic way when macroeconomic variables change. Reaction functions are sometimes legitimated by appealing to an intertemporal welfare objective, so that the policymaker is assumed to maximise the discounted sum of some function of reasonable objectives, say, output, unemployment, balance of payments, inflation, etc. Given the structure of the model, this optimisation problem yields a reaction function, which could in principle be estimated.

Following the pragmatic practice of many authors (see, e.g. Black, 1983), we make a shortcut by postulating that changes in the monetary policy instrument respond to changes in the endogenous and exogenous variables of the theoretical model. Specifically, we will estimate a so-called error correction model, where the difference between $H^*_t$ and $H^*_{t-1}$ is assumed to reflect both a response to the deviation between the *level* of H* in period t–1 and its long run equilibrium, which in turn is affected by the levels of the other variables in the model, and to short run fluctuations induced by past changes in H* as well as in the other variables.

Error correction models may be estimated in different ways, e.g. through single equation techniques as suggested by David Hendry et al., or by the multivariate approach developed by Sören Johansen (see Johansen, 1988). The Hendry approach is more structural in the sense that it often aims at identifying specific structural equations, while the Johansen approach, on the other hand, starts from a vector autoregressive (VAR) model, i.e. from a reduced form of the data generating process. An important step in this approach is to test for the *number* of error correction (cointegration) relations. Hypotheses about the error correction mechanisms can be tested independently from questions about exogeneity. In this paper we take a simple route which lies somewhere in between these two approaches. We postulate a number of error correction relations on *a priori* grounds and then go on and estimate a row of the reduced form (i.e. of the VAR model), specifically the row with H* as the l.h.s. variable. The estimated equation should therefore not really be interpreted as a structural reaction function but rather as a forecasting equation for the policy instrument H*.

On a priori grounds we have selected four long-run equilibrium (cointegration) relations among the variables in the theoretical model that we suspect may be important for the short run dynamics in H*. First, monetary policy may be expected to respond to the deviation between the optimal and the actual level of central bank debt, i.e., to the deviation between H* and H. Second, H* (and H) may be expected to have a trend in common with national income, Y. The residual from a regression of the level of H* on the level of Y has thus been included as an explanatory variable. Third, monetary policy can be expected to respond to »imbalances» between exports, X, and imports, which we denote by M. The difference between X and M is thus our third »equilibrium error» (since variables are expressed in logarithms in the empirical analyses, the difference between X and M is not equivalent with, but strongly related to, the actual trade balance). Fourth, we have allowed changes in H* to be affected by the ratio of foreign exchange reserves to imports (i.e., to the logarithmic difference between F and M). In line with the tradition of error correction models, we also allow past changes in H, H*, Y, X, M and F to influence the adjustment towards long run equilibrium. Finally, past changes in the loan stock L (which is part of the theoretical model) and in the gdp deflator P (which is not included in the model, since it is cast in real terms) are also allowed to affect the changes in H*.

The data on Y and X have been deseasonalised, as described in connection with Table 1 above, but not detrended. The GDP deflator (P), the loan stock (L), and imports (M) have been deseasonalised in a similar way.[11] As in Table 1, all variables have been used in logarithmic terms. The data sources are described in the Appendix.

Results from estimations of forecasting equations of this error correction type on quarterly data from 1954:1–1980:4 are reported in Table 2 (the early years of the 1950s and the 1980s have been excluded, in order to make the results less sensitive to turbulent periods; for the same reason, the regression includes a dummy for the outlier in the second quarter of 1962). The first column of Table 2 shows the parameter estimates after elimination of explanatory variables with clearly insignificant coefficients. We see that there appear to be two error correction mechanisms with a significant influence on H*. H* does respond, in the expected way, to the equilibrium errors given by the deviation between H and H* and by the deviation of H* from its long run linear relation to Y. In this sense, monetary policy may be said to have been *accommodating*. On the other hand, there also appears to be a *countercyclical* element in monetary policy, in the sense that the adjustment towards long run equilibrium is affected by the rate of growth of gdp (with a lag of three quarters). The two error correction mechanisms capturing various external imbalances are hardly significant, although changes in foreign reserves may be of some importance.

We also analysed the behaviour of H* within two subsamples. Neither a CUSUM test on the recursive residuals nor a simple Chow test[12], based on the two subsamples 1954:1–1968:4 and 1969:1–1980:4 show any signs of structural instability of the regression reported in the first column of Table 2. The power of these tests may, however, be disputed, particularly in light of the poor performance of the regression equation for the second subsample; cf. the third column of Table 2. The forecasting equation has therefore been re-estimated allowing for different explanatory variables in two subsamples.

As always, the choice of where to split the sample is somewhat arbitrary. We chose to truncate the sample at years 1968–69 on the basis of external information related to the official policy statements of the monetary authorities. As argued in Pekkarinen-Vartiainen (1993) as well as in Tarkka (1988), the official policy statements begin, from the late 1960s onwards, to emphasise almost exlusively the external balance of the economy as the target of monetary policy. This stands in clear contrast with the 1950s and the 1960s, when decisionmakers seemed to be more concerned with

Table 2. Estimated coefficients for different samples. (t-values in parantheses.)

| Regressor | 1954:1–1980:4 | 1954:1–1968:4 | 1969:1–1980:4 |
|---|---|---|---|
| Constant | .052 | .050 | .048 |
| | (3.234) | (2.366) | (1.124) |
| $\Delta \log H^*_{t-3}$ | .180 | .254 | .096 |
| | (2.228) | (2.328) | (.635) |
| $\Delta \log H_{t-3}$ | –.129 | –.119 | –.147 |
| | (–3.477) | (–2.478) | (–2.049) |
| $\Delta \log Y_{t-3}$ | –1.041 | –1.000 | –.998 |
| | (–2.303) | (–1.421) | (–1.526) |
| $\Delta \log X_{t-4}$ | –.226 | –.271 | –.221 |
| | (–1.330) | (–1.154) | (–.767) |
| $\Delta \log M_{t-4}$ | .236 | .322 | .202 |
| | (1.481) | (1.329) | (.867) |
| $\Delta \log F_{t-1}$ | –.131 | –.152 | –.193 |
| | (–1.568) | (–1.366) | (–1.278) |
| $\log H_{t-1} - \log H^*_{t-1}$ | .048 | .034 | .106 |
| | (2.371) | (1.398) | (1.821) |
| $\log H^*_{t-1} - \hat{\alpha} \log Y_{t-1}$ | –.116 | –.104 | –.139 |
| | (–2.836) | (–1.826) | (–1.389) |
| Dummy (1962:2) | –.743 | –.736 | – |
| | (–5.143) | (–4.977) | |
| $\bar{R}^2$ | .316 | .349 | .190 |
| Q | 24.68 | 17.44 | 29.97 |

[11] *Since the seasonal pattern has changed during the sample period and the changes have not been synchronised across variables, we have decided to use deseasonalised data rather than to include seasonal dummies. The series on H, H* and F have not been deseasonalised since these variables have no significant seasonal pattern.*

[12] *The test results are not reported, but they are available from the authors upon request. We are grateful to Johan Setterblad at the Stockholm School of Economics or helping us to perform the CUSUM test.*

Table 3. Estimated coefficients for different models. (t-values in parentheses.)

| Regressor | 1954:1–1968:4 | 1969:1–1980:4 |
|---|---|---|
| Constant | 1.165<br>(2.510) | –.158<br>(–2.269) |
| $\Delta\log H_{t-1}$ | –.108<br>(–2.466) | .263<br>(4.592) |
| $\Delta\log H_{t-3}$ | –.078<br>(–1.861) | – |
| $\Delta\log Y_{t-1}$ | –2.371<br>(–2.804) | – |
| $\Delta\log Y_{t-2}$ | –1.566<br>(–1.873) | – |
| $\Delta\log Y_{t-3}$ | –1.961<br>(–2.467) | – |
| $\Delta\log X_{t-1}$ | – | .433<br>(1.945) |
| $\Delta\log P_{t-3}$ | –1.237<br>(–1.787) | 4.749<br>(2.514) |
| $\Delta\log L_{t-1}$ | 1.241<br>(1.929) | – |
| $\Delta\log L_{t-3}$ | – | 3.719<br>(1.959) |
| $\Delta\log F_{t-2}$ | –.154<br>(–1.353) | – |
| $\Delta\log F_{t-4}$ | – | .458<br>(3.631) |
| $\log H^*_{t-1} - \hat{\alpha}\log Y_{t-1}$ | –.145<br>(–3.189) | – |
| $\log F_{t-1} - \log M_{t-1}$ | –.151<br>(–2.330) | – |
| Dummy (1962:2) | –.697<br>(–5.206) | – |
| $\bar{R}^2$ | .503 | .467 |
| Q | 13.98 | 11.53 |

other objectives such as loan expansion, employment and output, tightness of monetary markets and the banks' profitability. This suggests that inasmuch as there has been a change in the policy objective, it might be detected around the end of the 1960s.

The results are reported in Table 3 (again after elimination of insignificant factors). Between 1954 and 1968 monetary policy seems to have been counter-cyclical, as is evident from the first column of Table 3. Rapid growth of real income and rapid inflation was followed by decreases in H*. An error correction mechanism seems to have been operating with respect to the foreign reserves – imports ratio during this period. There is also some evidence of an accommodating pattern in the sense that deviations between the level of H* and its long run relation to the level of Y induce changes in H*. The positive correlation between the change in H* and the lagged change in the loan stock is a further indication of some accommodation.

The reaction function during 1969 – 1980 looks quite different, as can be seen from the second column of Table 3. There is no evidence of a counter-cyclical policy in any sense. Quite to the contrary, rapid inflation is followed by a rapid increase in H*. The highly significant positive coefficient of $\Delta H_{t-3}$ indicates that the central bank accommodates the banks' need for discount window money. Increases in foreign exchange reserves are also followed by increases in H*, which suggests that monetary policy has been geared towards external, rather than internal, balance (cf. Obstfeld, 1980).

The results suggest that there have been systematic patterns in the central bank's policy reactions. Since policy is influenced by the economy and the economy is influenced by policy, both mechanisms should strictly speaking be estimated simultaneously. With these first results at hand, a natural topic for further research would be a simultaneous analysis of these regularities.

## 6. *The policy choices*

We have found some indications of a stabilising monetary policy rule, but it seems to coexist with accommodating targets. For the earlier subperiod, the policy variable H* reacts to changes in output Y in a stabilising way, but it accommodates the banks' need for discount window money, as can be seen from the positive coefficients of L and H–H*.

This mixed picture of policy objectives is confirmed by an inspection of official policy documents. The memoranda of the Bank of Finland's Deputies from the 1950s reveal that although stabilisation purposes were acknowledged, they were often played down when other objectives – growth, investment and the profitability of the banks – were emphasised. The memoranda show a commitment to safeguarding the banking sector's profitability which should lead to an accommodating reaction: when the banks' liquidity deteriorated, typically towards the end of the boom, the Deputies grudgingly acknowledged the need to support the banks by letting the discount debt grow. As the difference H–H* roughly correlates with the banking sector's profitability, this policy objective should lead to a positive coefficient for the term H–H*. In this light, it is perhaps surprising that an accommodating reaction pattern does not come out more clearly from the data for the 1950s (cf. the second column of Table 2).

For the 1970s, it is easy to document the strive for external balance at the expense of stabilisation. The central bank's yearbooks emphasise the need for external stability every year, and the increase in unemployment that took place in the mid-1970s hardly gets any attention. This policy objective is also espoused by the Governor of the Bank of Finland in his book (Koivisto, 1978).

However, perhaps the most interesting discussions and policy choices relate to the regime and instrument kit of monetary policy, less to the specific use of the discount measures. Especially the 1950s are an interesting formative period in this respect. We conclude the analysis by describing in more detail some of these choices, in relation to the problems of the business cycle.

We have no econometric analysis of the effectiveness of monetary policy, in whichever way one would want to measure it. Yet one may suspect that the monetary policy regime was not ideally equipped for stabilisation purposes. The main reason for this is that discount window measures were probably inefficient in braking the buoyant loan expansion that took place in every boom, since the banks typically had very little or no central bank debt at the early stages of the cyclical upswing. When export demand was high, export income flooded in and generated a rapid increase in domestic loans which the discount debt mechanism could probably not very much dampen. In the model, decreasing H* in such a situation does constrain the loan expansion, since the difference H–H* shrinks and the banks' adjustment speed decreases. Yet one can suspect that the effect would not be very great on a bank whose central bank debt is well below H*[13].

When a recession approached, the banks' liquidity deteriorated and they had to increase their central bank debt. It is usually at this stage, at the end of the boom, that the actual central bank debt variable crosses the H*-variable from below. This story is confirmed in Figure 4, where we have depicted the difference (H–H*) together with the deviation from trend of real gdp. This very rough test for the impact of monetary policy suggests that the braking effect of higher discount rates was mainly felt at the end of the boom and still at the start of the recession. Tarkka (1985) has argued that monetary policy measures affect gdp with a lag of about 1.5–2 years, which would in turn suggest that a part of the braking effect is still felt in the early recession.

If this hypothesis is true, one would expect that the central bank would try to improve its control of the loan markets, in order to be able to dampen a loan expansion more effectively. The rapid loan expansion associated with the booms was clearly identified as a problem by the policymakers. This can be documented from the Bank's Deputies memoranda and from other sources as well (see Vartiainen, 1986). The obvious candidate for improvement would have been cash reserve policy, which was well known as a theoretical idea already in the 1950s. Conspicuously, it is indeed the case that a discussion about cash reserve policy turned up in the 1950s. In 1953 a governmental committee suggested a legislative reform that would have enhanced the government with the power to introduce regulations about the banks' cash reserve ratios. The reform was rejected for political reasons, since it was felt that it would interfere too much with the principle of free enterprise. Thus, one may suspect that there are political constraints behind the instability of the Finnish economy[14]. We do not know how well cash reserve policy would have worked, but it is perhaps a pity that it was never seriously tried and no empirical evidence about its effects accumulated.

If discount window measures remained the sole monetary policy instrument, even their use was treated with a lot of suspicion by pol-

[13] *For similar discussions about Swedish discount window policy, see Englund et al. (1985, 1989).*

[14] *Similarly, a Swedish-type proposal for the banks' mandatory investment in housing bonds was rejected.*

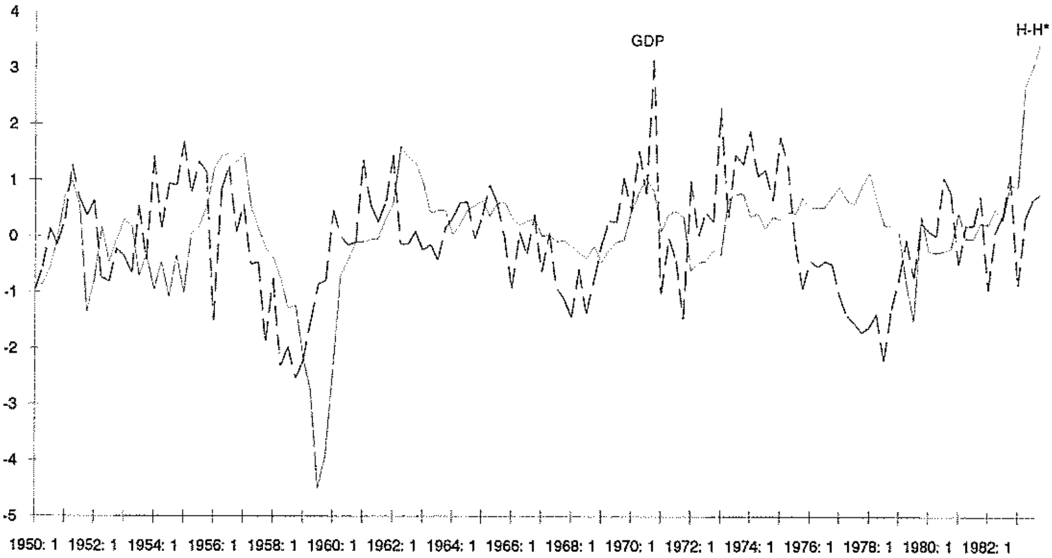


Fig. 4.

icymakers. There is a curious inconsistency in this respect in the central bank's official documents, especially in the 1950s. On the one hand, the Bank of Finland regards the banks' central bank debt as the main policy instrument. On the other hand, it deplores the very phenomenon as a breach of »sound financial equilibrium», which seems to require that the banks' loans always match their deposits. This laissez faire zeal, if carried to the extreme, would not leave the central bank with any instruments at all, once it is accepted that the interest rate structure is rigid. Then it is not surprising that policymakers did not want to intervene too much when loans grew rapidly in booms, since their growth was supported by the growth of deposits.

Another feature that distinguished the Finnish monetary policy regime from a textbook model was the fact that the central bank debt policy tool was clearly strategically laden. The Bank of Finland was faced with a handful of big banks or banking groups, each safeguarding its own market shares. This meant that the Deputies were often frightened of using their policy tool too vigorously, for fear of disrupting the market shares and competitive positions of the banks. A harsh policy which would have driven one bank to the edge of profitability was clearly out of the question.

To sum up, we suspect that the adopted monetary policy regime was not ideally suited for stabilisation purposes. But it would be simplistic to see this only as a »mistake» due to insufficient reasoning or incomplete information. The strategic choices witness of a commitment to rapid growth which meant that stabilisation objectives were perhaps de facto not high on the policymakers' agenda.

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## *Appendix*

### *Derivation of the banks' adjustment rule*

The Euler-Lagrange equation for (9) is

$$\text{(A.1)}\quad \ddot{L} - b\dot{L} - (A_1 c) + (A_0/2c) = 0.$$

This is a second-order linear differential equation. It is a necessary condition, and we have one free initial condition, since initial $\dot{L}$ can be chosen at will. The definite integral is $L = A_0/2A_1$ which also is the long term optimum. We can pick the negative root associated with the characteristic equation of (A.1) to obtain the solution as a sum of the definite integral and the deviation term:

$$\text{(A.2)}\quad L(t) = A_0/2A_1 + [L(0) - (A_0/2A_1)]\, e^{at},$$

where $a = \{\beta - [\beta^2 + (4A_1/c)]\}/2$ is the negative (stable) root of the characteristic equation, and where we have solved the constant to be $L^* = L(0) - (A_0/2A_1)$. The general solution (A.2) shows that the loan stock is equal to the static optimum $L^* = A_0/2A_1$ plus a term that decays in time so that the static optimum is approached. Differentiating (A.2) with respect to time yields $\dot{L} = a[L(0) - L^*)]\exp(at)$, and since $[L(0) - L^*]\exp(at) = L^* + [L(0) - L^*]\exp(at) - L^* = L(t) - L^*$, we have

$$\text{(A.3)}\quad \dot{L} = a(L - L^*).$$

### *The Data*

The data on exports, imports and gdp is taken from SNA accounts. The time series of currency reserves was gathered from the Bank of Finland's balance sheets for the earliest years 1950–51, from the Bank of Finland Monthly Bulletins for years 1952–59 and from the Bank of Finland BOF model data set for the later years. Data on bank loans is from Finnish Banking Statistics and the Statistical Bulletins of the Central Statistical Bureau.

The data on the central bank debt of the banks was obtained from Veikko Saarinen's study[15]. The H*-series is borrowed from Oksanen (1977) for years 1950–1963 and 1967–74. The construction of the series for the remaining years is reported in Vartiainen (1986). The computation of H* is straightforward once all the interest rates are known and a reasonable estimate for w is chosen. We adopted Oksanen's estimate 0.3 for w. The entire data set is available from the authors upon request.

[15] *Veikko Saarinen: Liikepankkien keskuspankkirahoituksen määrä ja kustannukset vuosina 1940–84. Bank of Finland, Department of monetary policy, Discussion paper 31.12.1984.*